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## Standard Specification for Coatings of Cadmium-Zinc Mechanically Deposited<sup>1</sup>

This standard is issued under the fixed designation B816; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 *General*—This specification covers the requirements for a coating that is a mixture of cadmium and zinc deposited on metallic products by mechanical deposition. The coating is provided in four thickness classes (see [Table 1](#)) and several finish types (see [Table 2](#)).

1.2 *Toxicity*—**Warning:** Cadmium is toxic; therefore these coatings should not be used on articles that will contact food or beverages, or for dental and other equipment that may be inserted into the mouth. Also, the coatings should not be used on articles that will be heated to high temperatures, because cadmium will form toxic fumes. Similarly, if coated articles are welded, soldered, or otherwise heated during fabrication, adequate ventilation should be provided to exhaust toxic fumes.

1.3 *Similar Documents*—Other kinds of mechanically deposited coatings are covered by Specifications [B635](#), [B695](#), and [B696](#).

1.4 The following precautionary caveat pertains only to the test method portion, Section 9, of this specification. *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

### 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

[B117 Practice for Operating Salt Spray \(Fog\) Apparatus](#)

[B183 Practice for Preparation of Low-Carbon Steel for Electroplating](#)

[B242 Guide for Preparation of High-Carbon Steel for Electroplating](#)

[B320 Practice for Preparation of Iron Castings for Electroplating](#)

[B322 Guide for Cleaning Metals Prior to Electroplating](#)

[B374 Terminology Relating to Electroplating](#)

[B487 Test Method for Measurement of Metal and Oxide Coating Thickness by Microscopical Examination of Cross Section](#)

[B499 Test Method for Measurement of Coating Thicknesses by the Magnetic Method: Nonmagnetic Coatings on Magnetic Basis Metals](#)

[B571 Practice for Qualitative Adhesion Testing of Metallic Coatings](#)

[B602 Test Method for Attribute Sampling of Metallic and Inorganic Coatings](#)

[B635 Specification for Coatings of Cadmium-Tin Mechanically Deposited](#)

[B695 Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel](#)

[B696 Specification for Coatings of Cadmium Mechanically Deposited](#)

[B697 Guide for Selection of Sampling Plans for Inspection of Electrodeposited Metallic and Inorganic Coatings](#)

[B762 Test Method of Variables Sampling of Metallic and Inorganic Coatings](#)

[E27 Method for Spectrographic Analysis of Zinc and Zinc Alloys by the Solution-Residue Technique](#)<sup>3</sup>

[E396 Test Methods for Chemical Analysis of Cadmium](#)

[E536 Test Methods for Chemical Analysis of Zinc and Zinc Alloys](#)

[F1470 Practice for Fastener Sampling for Specified Mechanical Properties and Performance Inspection](#)

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> Withdrawn.

**TABLE 1 Thickness Classes**

Class	Coating Thickness Minimum, $\mu\text{m}$	Typical Applications
7	7	Automotive fasteners
12	12	Increased corrosion resistance (for example, bellville washers)
25	25	Exterior hardware
50	50	Pole line hardware in severe environments

**TABLE 2 Coating Types**

Type	Description	Typical Applications
I	As-coated, without supplementary treatments.	Lowest cost where white corrosion products are acceptable. For elevated temperature application that will degrade Type II coatings (see 1.2).
Ila	With yellow to bronze color supplementary chromate coating.	Delay the appearance of white corrosion products. Increase total corrosion protection.
Ilb	With brown to olive drab color supplementary chromate coating.	Greater corrosion resistances than Ila. To provide a match to military equipment.
Ilc	Type Ila, dyed.	Color coding Decorative purposes
Ild	Type Ila with an added lubricant or organic finish (oil, wax, lacquer, etc.)	Lubricity Maximum corrosion resistance

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### 3. Terminology

3.1 *Definitions*—Some of the terms used in this are defined in Terminology B374.

### 4. Classification

4.1 *Thickness Classes*—The coating is classified in four thickness classes, as defined in Table 1.

4.2 *Coating Types*—The coating is classified by type, as defined in Table 2.

### 5. Ordering Information

5.1 In order to make the application of this specification complete, the purchaser needs to supply the following information to the seller on the purchase order or other governing documents:

5.1.1 The name, designation, and year of issue of this specification,

5.1.2 Thickness class (see 4.1), including a maximum thickness if appropriate,

5.1.3 Coating type (see 4.2), including required color if Type Iic is used, and required lubricant or organic finish if Type Iid is used,

5.1.4 Nature of the substrate, for example: high-carbon steel, mild steel, copper, brass:

5.1.4.1 State if precoating stress relief heat treatment is required and the time and temperature to be used if different from the standard values (see section 12.1),

5.1.4.2 State if special pretreatments are required to modify the surface of the article (see Note 1),

5.1.4.3 If special cleaning precautions are to be followed (see A1.1), and

5.1.5 Identification of significant surfaces (see 7.4.2).

5.1.6 Requirements and methods of testing one or more of the following:

5.1.6.1 Need for and type of special test specimens (see 9.1),

5.1.6.2 Appearance (see 7.3),

5.1.6.3 Deposit composition (see 9.2),

5.1.6.4 Thickness (see 9.5),

5.1.6.5 Adhesion (see 9.6),

5.1.6.6 Corrosion resistance (see 9.7),

5.1.6.7 Absence of hydrogen embrittlement, waiting time prior to testing and testing loads (see 9.8), and

5.1.7 The sampling plan to be used (see 8.1) and responsibility for inspection (see section 13.1).

## 6. Significance and Use

6.1 *Corrosion Resistance, General*—This functional coating is used to provide corrosion resistance. The performance of this coating depends largely on its thickness and the kind of environment to which it is exposed. Published results of environmental corrosion studies have demonstrated that the coating provides corrosion resistance greater than equivalent thicknesses of zinc coatings in industrial environments and greater corrosion resistance than equivalent thicknesses of cadmium coatings in marine environments.<sup>4</sup>

6.2 *Galvanic Corrosion Resistance*—The galvanic couple that results in the corrosion of steel and aluminum parts in contact with each other in corrosive environments can also be minimized by plating the steel parts with this mechanically deposited coating.

6.3 *Hydrogen Embrittlement, Absence of*—The mechanical coating process does not produce any permanent hydrogen embrittlement in products made from high-strength steels, for example, fasteners or lock washers.

## 7. Coating Requirements

7.1 *Nature of Coating*—The coating shall be a mechanically deposited mixture of cadmium and zinc with the composition 45 to 75 mass % zinc, remainder cadmium.

### 7.2 Coating Process:

7.2.1 *Coating*—The cadmium-zinc coating shall be produced by mechanical deposition in accordance with the process description given in **Annex A1**.

7.2.2 *Supplementary Treatments*—Type II coatings shall be produced by treatment with acidic solutions that contain hexavalent chromium compounds and anions that act as catalysts or film-forming compounds.

### 7.3 Appearance:

7.3.1 *General*—The coating on all readily visible surfaces shall be uniform in appearance, well compacted, and complete in coverage. Superficial staining from rinsing and drying and mild variations in color and luster are acceptable.

7.3.2 *Surface Defects*—Defects and variations in appearance in the coating that arise from surface conditions of the substrate (scratches, pores, roll marks, inclusions, etc.) and that persist in the coating despite the observance of good metal finishing practices shall not be cause for rejection.

NOTE 1—Coatings generally perform better in service when the substrate over which they are applied is smooth and free of torn metal, inclusions, pores, and other defects. The specifications covering the unfinished products should provide limits for these defects. A metal finisher can often remove defects through special treatments, such as grinding, polishing, abrasive blasting, chemical etches, and electropolishing. However, these are not normal in the treatment steps preceding the application of the coating. When they are desired, they are the subject of special agreement between the purchaser and the seller.

### 7.4 Thickness:

7.4.1 *Conformance to Specified Class*—The thickness of the coating everywhere on the significant surfaces shall conform to the requirements of the specified class as defined in **4.1**.

7.4.2 *Significant Surfaces*—Significant surfaces are usually defined as those normally visible (directly or by reflection) that are essential to the appearance and serviceability of the article when assembled in normal position; or that can be the source of corrosion products that deface visible surfaces on the assembled article. Significant surfaces are further defined at those surfaces that are identified as such by the purchaser, for example, by indicating them on an engineering drawing of the product or by marking a sample item of product.

7.4.3 *Minimum Thickness Requirement*—The coating requirement of this specification is a minimum requirement; that is, the coating thickness is required to equal or exceed the specified thickness everywhere on the significant surfaces. Variation in the thickness from point to point on an article and from article to article in a production lot is inherent in mechanically deposited coatings. Therefore, if all of the articles in a production lot are to meet the thickness requirement, the average coating thickness for the production lot as a whole will be greater than the specified minimum.

NOTE 2—The thickness of mechanically deposited coatings varies from point to point on the surface of a product, characteristically tending to be thicker on flat surfaces, and thinner at exposed edges, sharp projections, shielded or recessed areas, and interior corners and holes, depending on the dimensions, with such thinner areas often being exempted from thickness requirements.

NOTE 3—Processes used to produce Type II finishes remove some of the coating. Because thickness requirements apply to the finished article, additional thicknesses may have to be applied to compensate for the metal removed in the Type II process.

7.5 *Adhesion*—The coating shall be adherent, as defined or tested in accordance with **9.6**.

### 7.6 Corrosion Resistance:

7.6.1 *Type I Coatings on Ferrous Articles*—Type I coated ferrous articles shall not develop red corrosion products (“rust”) when submitted to the 5 % salt spray test for the following times:

<sup>4</sup> Holford, Raymond N., Jr., “Five Year Outdoor Exposure Corrosion Comparison,” Mechanical Finishing, July 1988.